



Date: 2002-02-06

## Engineering Change Order – Class I

### **Brief description of the proposed change(s) :**

Installation of two short MCBX dipole correction magnets in the Inner Triplets of points 2 and 8 . These magnets are based on the coil assemblies of the two prototype magnets mounted in new outer shells that include the support flange such that the mechanical interface to the MQXB is identical to the series MCBX magnets.

The proposed equipment codes are:

- MCSXS to be installed in IR 2 (based on the first MCBX prototype)
- MCBXT to be installed in IR 8 (based on the second MCBX prototype)

<b>Equipment concerned :</b> <b>MCBX</b> <b>LQXB (IR2/8)</b>	<b>Drawings concerned :</b> <b>LHCMCBXS001</b> <b>LHCMCBXT001</b> <b>CCD Drawing folders:</b> <b>MCBXA Baseline Drawings</b> <b>MCBXS As Built</b> <b>MCBXT As Built</b>	<b>Documents concerned :</b> <b>LHC-LQX-ES-0005 rev 0.1</b> <b>draft</b>
<b>PE in charge of the item :</b> <b>Mikko Karppinen LHC-ICP</b>	<b>PE in charge of parent item in PBS :</b> <b>Jim Kerby FNAL</b>	
<b>Decision of the Project Engineer :</b> <input type="checkbox"/> Rejected. <input type="checkbox"/> Accepted by Project Engineer, no impact on other items. <i>Actions identified by Project Engineer</i> <input checked="" type="checkbox"/> Accepted by Project Engineer, but impact on other items. <i>Comments from other Project Engineers required</i> <i>Final decision &amp; actions by Project Management</i>	<b>Decision of the PLO for Class I changes :</b> <input type="checkbox"/> Not requested. <input type="checkbox"/> Rejected. <input checked="" type="checkbox"/> Accepted by the Project Leader Office. <i>Actions identified by Project Leader Office</i>	
<b>Date of Approval :</b> 2002-01-10	<b>Date of Approval :</b> 2002-02-06	
<b>Actions to be undertaken :</b> Modify the drawings concerned to reflect the changes described in this ECO.		
<b>Date of Completion :</b>	<b>Visa of QA Officer :</b>	

Note : when approved, an **Engineering Change Request** becomes an **Engineering Change Order/Notification**.

**1. DETAILED DESCRIPTION****by originator and/or PE**

Modification of two existing MCBX prototypes and their integration into the first two Inner Triplet cold masses at Fermilab. These magnets are shorter than the series magnets (560 mm instead of 700 mm), but the interfaces of the MCBXS and MCBXT are identical to the series magnets and according to LHC-LQX-ES-0005 rev 1.0. The proposed equipment codes are MCBXS and MCBXT to distinguish from the series magnets (MCBX\_).

**2. REASONS FOR CHANGE****by originator**

Delays in the series MCBX fabrication.

**3. IMPACT ON COST, SCHEDULE & PERFORMANCE****by originator**

FNAL cannot test the MQXB magnets without an MCBX. Waiting for the first series MCBX, foreseen in June 2002, would stop the work at FNAL.

With the short MCBXT, delivered to FNAL by the end of year 2001, the cold mass of the first Q2 can be assembled in the beginning of 2002. The short MCBXS is required in March 2002 for the second Q2.

The parameters of MCBXS and MCBXT are compared to the series MCBX in Table I.

**Table I. Main parameters of MCBXS, MCBXT, and series MCBX**

	Unit	MCBXS		MCBXT		Series MCBX	
		MCBXV	MCBXH	MCBXV	MCBXH	MCBXV	MCBXH
Nominal field	T	3.30	3.09	3.31	3.31	3.26	3.35
Magnetic length	m	0.41	0.38	0.41	0.38	0.48	0.45
Nominal operation current	A	513	600	492	600	550	550
Working temperature	K	1.9	1.9	1.9	1.9	1.9	1.9
Turns per coil		414	406	414	406	360	440
Peak field	T	4.44	4.46	4.42	4.61	3.7	4.0
Quench margin at 1.9 K	%	50.8	48.3	52.0	47.7	56	53
Theoretical quench current at 1.9 K	A	1043	1161	1025	1147	1240	1175.0
Stored energy	kJ	21.32	29.88	18.40	27.00	26.5	43.4
Self inductance	mH	162	166	152	150	175.2	287.2
<b>SC-wire</b>							
Cu/Sc-ratio		1.6	1.6	1.6	1.6	1.6	1.6
Metal height	mm	1.53	1.53	1.53	1.53	1.53	1.53
Metal width	mm	0.85	0.85	0.85	0.85	0.85	0.85
Insulation thickness	mm	0.06	0.06	0.06	0.06	0.06	0.06
Insulation material		PVA	PVA	PVA	PVA	PVA	PVA
<b>Main dimensions</b>							
Overall length	mm	560		560		700	
Overall diameter	mm	400		400		400	
Aperture	mm	90		90		90	
Coil length	mm	500	500	500	500	640	640
Coil inner diameter	mm	90	123.7	90	123.7	90.4	120.8
Coil outer diameter	mm	119.7	146.8	119.7	146.8	116.8	147.2
Shrink ring inner diameter	mm	150.6		150.6		151	
Shrink ring outer diameter	mm	200		180		180	
Yoke inner diameter	mm	200.4		180.4		180.2	
Yoke outer diameter	mm	329.2		329.2		329.2	
Outer shell outer diameter	mm	350		350		350	
Total mass	kg	350		350		400	

**4. IMPACT ON OTHER ITEMS****by originator and/or PE**

None.

**5. CHANGE CLASS****by Project Engineer**

Class I

**6. COMMENTS (COMPULSORY)****by Project Engineer**

The use of the prototype magnets was proposed during the discussions between FNAL and CERN last June in order to avoid further delays in the fabrication of the Inner Triplet cold masses.

The reduced orbit correction is acceptable for the Inner Triplets of IR 2 and 8.

**7. COMMENTS**

By Werner Herr and Oliver Bruning:

Reductions in the MCBX strength will limit the maximum crossing angle at the IP and might exclude the possibility of reversing the sign of the spectrometer magnets in IR8.

**8. COMMENTS (IF ANY)****by PLO appropriate Committees**